Thermophysical Puzzles in Metastable Liquid and Solid Forms of Water (Invited)

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We will discuss new evidence [1-4] relating to the hypothesis that the anomalies of liquid and glassy water may be connected to the existence of a ``second" critical point in a metastable region of the phase diagram (about -60 C). The two phases, a low-density liquid and a high-density liquid, that exist below the second critical point may be the analogs of recently-discovered low-density and high-density phases of metastable "glassy" solid water. We will briefly review recent work elucidating the connection between the liquid and solid amorphous phases, including very recent work that probes the region between the stable liquid and the glass [1]. Then we will discuss attempts to model the essential features of a liquid that give rise to a second critical point [2-4]. It is possible that there are other liquids for which second critical points exist, so understanding one such liquid, water, may help in understanding other tetrahedral liquids [5].

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